The documentation and process conversion measures necessary to comply with this revision shall be completed by 3 December 2003.

INCH-POUND

MIL-PRF-19500/548E
3 September 2003
SUPERSEDING
MIL-PRF-19500/548D
8 June 2001

PERFORMANCE SPECIFICATION

* COUPLER, OPTO ELECTRONIC, SEMICONDUCTOR DEVICE, SOLID STATE,
TYPES 4N47, 4N47A, 4N48, 4N48A, 4N49, 4N49A, 4N47U, 4N48U, 4N49U, AND 4N49BU,
JAN, JANTX, JANTXV, AND JANS

This specification is approved for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers the performance requirements for solid state optically coupled isolators in which a gallium aluminum arsenide diode light source is optically coupled to a silicon NPN phototransistor. Four levels of product assurance are provided for each type as specified in MIL-PRF-19500.

* 1.2 Physical dimensions. See figure 1 (4N47, 4N47A, 4N48, 4N48A, 4N49, and 4N49A) (similar to TO-99), and figure 2 (4N47U, 4N48U, 4N49U, and 4N49BU).

1.3 Maximum ratings. Unless otherwise specified, maximum ratings apply to all case outlines, T_A = +25°C.

1.3.1 Infrared-emitting diode maximum rating.

V_R	I_F (1) (2)	I_P (3)
Vdc	mA dc	A (pk)
2	40	1

(1) Derate linearly to 125°C at 0.67 mA/°C above +65°C.
(2) Minimum recommended operating I_F is 1 mA dc at +25°C.
(3) 1.0 µs pulse width, 300 pps.

* 1.3.2 Phototransistor maximum rating.

Type	V_{CEO}	V_{CBO}	V_{EBO}	$P_{T(1)}$	I_C
	Vdc	Vdc	Vdc	mW	mA dc
4N47, 4N47A, 4N48, 4N48A, 4N49, 4N49A, 4N47U, 4N48U, 4N49U	40	45	7	300	50
4N49BU	60	60			

(1) Derate linearly to 125°C at 3 mW/°C above +25°C.

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Defense Supply Center Columbus, ATTN: DSCC-VAC, P.O. Box 3990, Columbus, OH 43216-5000, by using the Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

AMSC N/A FSC 5980

1.3.3 Total device ratings.

T_A	T_{STG}	V_{IO}
°C	°C	Vdc
-65 to +125	-65 to +125	1,000 V (max)

1.4 Primary electrical characteristics. Unless otherwise specified, electrical characteristics apply to all case outlines, T_A = +25°C.

1.4.1 LED (input) characteristics.

Limits	I_R	V_{F1}	V_{F2} (1)
	V_R = 2 Vdc	I_F = 10 mA dc	I_F = 250 uA dc
	µA dc	Vdc	Vdc
Minimum		0.8	1.2
Maximum	100	1.5	

(1) Required to screen out LED's with "snapback" junctions.

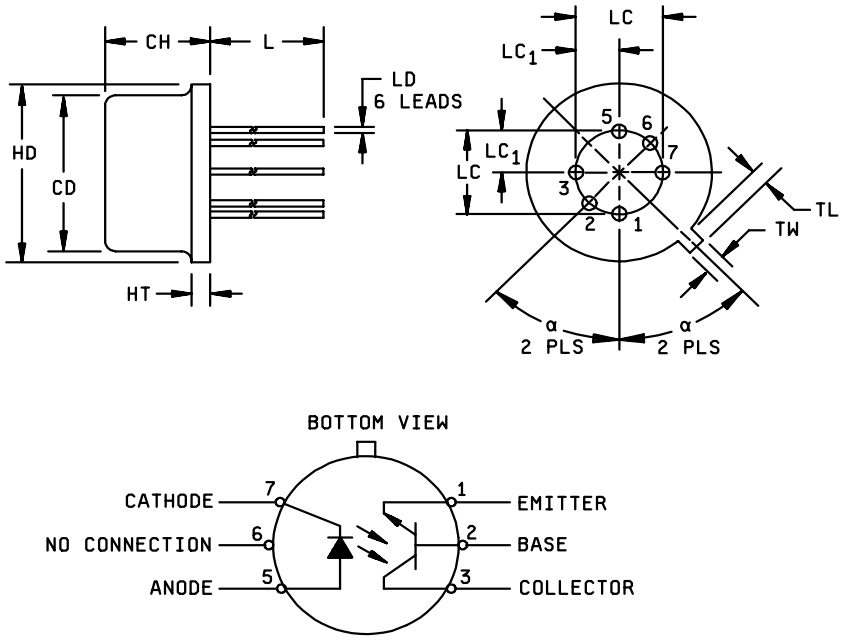
* 1.4.2 Phototransistor (output) characteristics.

Limits	I_C off	$V_{(BR)CEO}$	$V_{(BR)CBO}$	$V_{(BR)EBO}$	h_{FE}
	V_{CE} = 20 V	I_C = 1 mA	I_E = 100 µA	I_E = 100 µA	V_{CE} = 5 Vdc, I_C = 10 mA dc, I_F = 0
	nA (maximum)	Vdc	Vdc	Vdc	
4N47, 4N47A, 4N48, 4N48A, 4N49, 4N49A, 4N47U, 4N48U, 4N49U	100	40	45	7	100
4N49BU		60	60		

* 1.4.3 Coupled (transfer) characteristics.

Limits	R_{IO} at 1,000 V (see 4.5.5)	C_{IO} V = 0, f = 1 MHz (see 4.5.5)	Phototransistor mode switching (see figure 3)						Photodiode mode switching (see figure 3)	
			t_r			t_f			t_r	t_f
			4N47 4N47A 4N47U	4N48 4N48A 4N48U	4N49 4N49A 4N49U 4N49BU	4N47 4N47A 4N47U	4N48 4N48A 4N48U	4N49 4N49A 4N49U 4N49BU		
	Ohms	pf	µs	µs	µs	µs	µs	µs	µs	µs
Minimum	10^{11}									
Maximum		5	20	20	20	20	20	20	3	3

Limits	$V_{CE(SAT)}$			$I_{C(ON)}$		
	4N47 4N47A 4N47U	4N48 4N48A 4N48U	4N49 4N49A 4N49U 4N49BU	4N47 4N47A 4N47U	4N48 4N48A 4N48U	4N49 4N49A 4N49U 4N49BU
	I_F = 2 mA I_C = .5 mA	I_F = 2 mA I_C = 1 mA	I_F = 2 mA I_C = 2 mA	V_{CE} = 5 V I_F = 1 mA	V_{CE} = 5 V I_F = 1 mA	V_{CE} = 5 V I_F = 1 mA
	V dc	V dc	V dc	mA dc	mA dc	mA dc
Minimum				0.5	1.0	2.0
Maximum	0.3	0.3	0.3		5.0	10.0

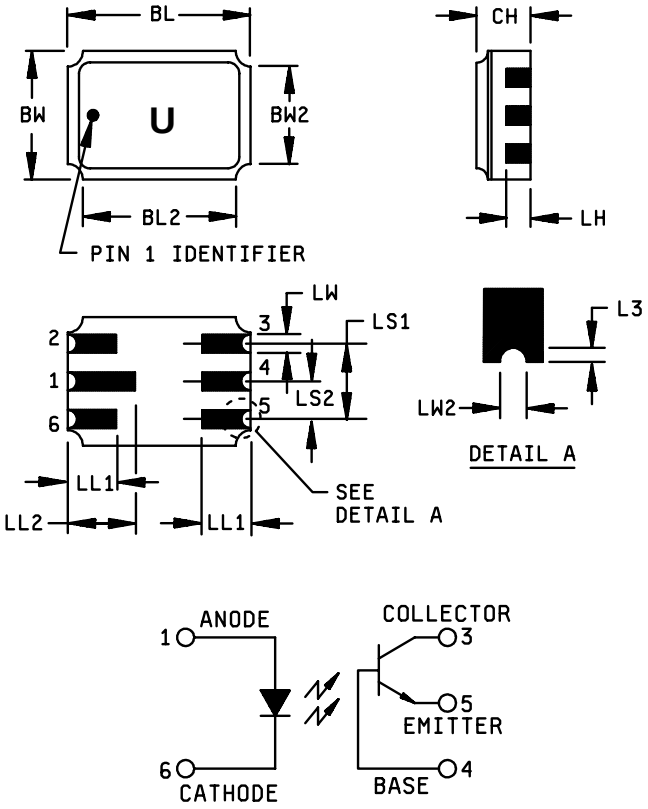


Ltr	Dimensions				Notes
	Inches		Millimeters		
	Min	Max	Min	Max	
CD	.305	.335	7.75	8.51	
CH	.155	.185	3.94	4.70	
HD	.335	.370	8.51	9.40	
HT		.040		1.02	
LC	.200 T.P.		5.08 T.P.		3
LC1	.100 T.P.		2.54 T.P.		3
LD	.016	.019	0.41	0.48	
LL	.500	.600	12.70	15.24	
TL	.029	.045	0.74	1.14	
TW	.028	.034	0.71	0.86	
α	45° T.P.		45° T.P.		

NOTES:
1. Dimensions are in inches.
2. Metric equivalents are given for general information only.
3. T.P. designates true position. Leads having maximum diameter .019 (0.48 mm) measured in gauging plane .054 +.001, -.000 (1.37 +0.03, -0.00 mm) below the seating plane of the device shall be within .007 (0.18 mm) of their true position relative to a maximum width tab.
4. In accordance with ASME Y14.5M, diameters are equivalent to Φx symbology.
5. Device types 4N47, 4N48, and 4N49 have the collector internally connected to the case.
6. Device types 4N47A, 4N48A, and 4N49A have the collector isolated from the case.

* FIGURE 1. Dimensions and configuration (4N47, 4N47A, 4N48, 4N48A, 4N49, and 4N49A) (similar to TO-99).

Ltr	Dimensions			
	Inches		Millimeters	
	Min	Max	Min	Max
BL	.240	.250	6.10	6.35
BL2		.250		6.35
BW	.165	.175	4.19	4.44
BW2		.175		4.44
CH	.066	.080	1.68	2.03
LH	.036	.044	0.91	1.12
LL1	.060	.070	1.65	1.78
LL2	.082	.098	2.08	2.49
L3	.003	.007	0.08	0.18
LS1	.095	.105	2.41	2.67
LS2	.045	.055	1.14	1.39
LW	.022	.028	0.56	0.71
LW2	.006	.022	0.15	0.56



NOTES:
1. Dimensions are in inches.
2. Metric equivalents are given for general information only.
3. Ceramic package.

* FIGURE 2. Dimensions and configuration (4N47U, 4N48U, 4N49U, and 4N49BU).

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3 and 4 of this specification. This section does not include documents cited in other sections of this specification or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements documents cited in sections 3 and 4 of this specification, whether or not they are listed.

2.2 Government documents.

2.2.1 Specifications, standards and handbooks. The following specifications, standards and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the issue of the Department of Defense Index of Specifications and Standards (DoDISS) and supplement thereto, cited in the solicitation (see 6.2).

SPECIFICATION

DEPARTMENT OF DEFENSE

MIL-PRF-19500 - Semiconductor Devices, General Specification for.

STANDARD

DEPARTMENT OF DEFENSE

MIL-STD-750 - Test Methods for Semiconductor Devices.
MIL-STD-883 - Test Methods Standard Microcircuits

(Unless otherwise indicated, copies of the above specifications, standards, and handbooks are available from the Document Automation Production Services (DAPS), Building 4D (DPM–DODSSP), 700 Robbins Avenue, Philadelphia, PA 19111-5094.)

2.3 Order of precedence. In the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 General. The individual item requirements shall be as specified in MIL-PRF-19500 and as modified herein.

3.2 Qualification. Devices furnished under this specification shall be products that are manufactured by a manufacturer authorized by the qualifying activity for listing on the applicable qualified manufacturer's list (QML) before contract award (see 4.2 and 6.3).

3.3 Abbreviations, symbols, and definitions. Abbreviations, symbols, and definitions used herein shall be as specified in MIL-PRF-19500 and as follows.

$I_{C(OFF)}$	Off-state collector current.
$I_{C(ON)}$	On-state collector current.
I_P	Peak forward pulse current.
R_{IO}	Input to output resistance.
V_{IO}	Input to output voltage.

* 3.4 Interface and physical dimensions. The interface and physical dimensions shall be as specified in MIL-PRF-19500, and figures 1 (similar to TO-99) and 2 (surface mount) herein. With the approval of the qualifying activity, the use of organic material is authorized.

* 3.4.1 Lead finish for 4N47, 4N47A, 4N48, 4N48A, 4N49, 4N49A. Lead finish shall be solderable in accordance with MIL-STD-750, MIL-PRF-19500, and herein. Where a choice of lead finish is desired, it shall be specified in the acquisition document (see 6.2).

* 3.4.2 Lead finish for 4N47U, 4N48U, 4N49U, and 4N49BU. Terminal pad shall be tungsten co-fired to the ceramic package. Terminal pad finish shall be gold plated or solder dipped. Where a choice of lead finish is desired, it shall be specified in the acquisition document (6.2).

* 3.4.3 Die shear. Die shear process control for eutectic alloyed die of less than 1.5×10^{-5} square inches of surface area shall be in accordance with the requirements for small area die in method 2019 of MIL-STD-883. Die shear process control on epoxy mounted die is not required for JAN, JANTX, and JANTXV.

3.4.4 Moisture content. The internal moisture content of the device package shall not exceed 10,000 ppm at +100°C. The “U” style package is exempt from this requirement due to internal cavity size.

3.5 Marking. Marking shall be in accordance with MIL-PRF-19500.

3.6 Electrical performance characteristics. Unless otherwise specified herein, the electrical performance characteristics are as specified in 1.3, 1.4, and table I.

3.7 Electrical test requirements. The electrical test requirements shall be the subgroups specified in table I herein.

3.8 Workmanship. Semiconductor devices shall be processed in such a manner as to be uniform in quality and shall be free from other defects that will affect life, serviceability, or appearance.

4. VERIFICATION

4.1 Classification of inspections. The inspection requirements specified herein are classified as follows:

a. Qualification inspection (see 4.2).

b. Screening (see 4.3).

c. Conformance inspection (see 4.4).

4.2 Qualification inspection. Qualification inspection shall be in accordance with MIL-PRF-19500, 4.2.1, and 4.4.4.

4.2.1 Group E qualification. Group E inspection shall be performed for qualification or re-qualification only. In case qualification was awarded to a prior revision of the associated specification that did not request the performance of table II tests, the tests specified in table II herein shall be performed by the first inspection lot of this revision to maintain qualification.

4.3 Screening (JANS, JANTX, and JANTXV levels only). Screening shall be in accordance with table IV of MIL-PRF-19500, and as specified herein. The following measurements shall be made in accordance with table I herein. Devices that exceed the limits of table I herein shall not be acceptable.

Screen (see table IV of MIL-PRF-19500)	Measurement	
	JANS level	JANTX and JANTXV level
3	See 4.3.1	See 4.3.1
9	$I_{C(OFF)1}$ and h_{FE}; 100 percent read and record.	$I_{C(OFF)1}$ and h_{FE}; 100 percent read and record.
10	See 4.3.2	See 4.3.2
11	I_R, $I_{C(OFF)1}$, h_{FE}, and $I_{C(ON)2}$; $\Delta I_{C(OFF)1}$ = 100 percent of initial value or 25 nA dc (whichever is greater) Δh_{FE} ±20 percent of initial reading.	I_R, $I_{C(OFF)1}$, h_{FE}, and $I_{C(ON)2}$; $\Delta I_{C(OFF)1}$ = 100 percent of initial value or 25 nA dc (whichever is greater) Δh_{FE} ±20 percent of initial reading.
12	See 4.3.3	See 4.3.3
13	Subgroups 2 and 3 of table I herein; $\Delta I_{C(OFF)1}$ = 100 percent of initial value or 25 nA dc, (whichever is greater) Δh_{FE} = ±20 percent of initial reading; $\Delta I_{C(ON)2}$ = ±25 percent of initial reading; ΔI_R = 100 percent of initial value or 25 µA dc, (whichever is greater).	Subgroup 2 of table I herein; $\Delta I_{C(OFF)1}$ = 100 percent of initial value or 25 nA dc (whichever is greater) Δh_{FE} = ±20 percent of initial reading; $\Delta I_{C(ON)2}$ = ±25 percent of initial reading ΔI_R = 100 percent of initial value or 25 µA dc, (whichever is greater).

4.3.1 Temperature cycling. All devices shall be subjected to temperature cycling in accordance with method 1051 of MIL-STD-750, test condition B, except $T_{(min)}$ = -55°C; 10 cycles, 15 minutes minimum dwell.

4.3.1.1 Monitored temperature cycling. One cycle of monitored temperature cycling shall be performed on 100 percent of the devices. This test shall be performed any time after the completion of the thermal shock test specified or it may be the last of the ten thermal cycles. All junctions shall be monitored for electrical continuity. Any discontinuity shall be cause for rejection of the device(s) under test. If 10 percent or more of the number of devices subjected to monitored temperature cycling fail, the entire lot shall be rejected as "TX", "TXV", or "S" types.

4.3.2 High temperature reverse bias (HTRB). All devices shall be subjected to high temperature reverse bias in accordance with method 1039 of MIL-STD-750, test condition A, T_A = +125°C, I_F = 0, V_{CB} = 36 V dc for 48 hours minimum.

4.3.3 Power burn-in conditions. Power burn-in conditions are as follows: See figure 4 for burn-in circuit. V_{CC} = 20 V dc, V_{CE} = 10 ±5 V dc, I_F = 40 mA dc, P_T = 275 ±25 mW at T_A = +25°C ±3°C. No heat sink or forced air cooling directly on the devices shall be permitted.

4.4 Conformance inspection. Conformance inspection shall be in accordance with MIL-PRF-19500 and as specified herein.

4.4.1 Group A inspection. Group A inspection shall be conducted in accordance with MIL-PRF-19500 and table I herein.

4.4.2 Group B inspection. Group B inspection shall be conducted in accordance with the conditions specified for subgroup testing in table VIa (JANS) and table VIb (JAN, JANTX, and JANTXV) of MIL-PRF-19500, and as follows. Electrical measurements (end-points) and delta requirements shall be in accordance with table I, subgroup II herein.

4.4.2.1 Group B inspection, table VIa (JANS) of MIL-PRF-19500.

Subgroup	Method	Condition
B3	1056	Test condition B.
B3	1071	Fine leak: Condition G or H; Gross leak: Condition C
B3	2037	Bond strength: Test condition A. Sample used in decap internal visual design verification may be used in bond strength and die shear. Sample is in units.
B4		High temperature isolation voltage test (see 4.5.2) and as follows: V_{ISO} = 150 V dc, T_A = +125°C, t = 24 hours minimum. n = 22, c = 0, small lot sample size n = 8, c = 0.
B4	1037	V_{CE} = 10 V dc, I_F = 20 mA dc, P_T = 275 ±25 mW at T_A = +25°C ±3°C (see figure 4), $t_{on} = t_{off}$ = 3 minutes minimum for 2,000 cycles. No heat sink or forced air cooling directly on the device shall be permitted.
B5	1027	V_{CE} = 10 V dc, T_A = +100°C ±3°C for 96 hours, P_T = 275 ±25 mW, I_F = 20 mA dc (see figure 4), or adjusted as required by the chosen T_A to give an average lot T_J = +200°C. Marking legibility requirements shall not apply.
B5	2037	(Al-Au die interconnects only), test condition A.
B5	1018	Internal water vapor test, n = 3, c = 0; n = 5, c = 1.

Note: B-5 not applicable to U package style.

B6		Not applicable.

4.4.2.2 Group B inspection, table VIb (JAN, JANTX, and JANTXV) of MIL-PRF-19500.

Subgroup	Method	Condition
B2	1056	Temperature cycling: Test condition B (25 cycles). Total test time = 72 hours maximum.
B2	1071	Fine leak - condition G or H, gross leak - condition C.
B3		High temperature isolation voltage test conditions: V_{ISO} = 150 V dc (see 4.5.2), T_A = +125°C, t = 24 hours minimum. n = 22, c = 0, small lot sample size = 8, c = 0.
B3	1027	I_F = 20 mA dc, P_T = 275 ± 25 mW at T_A = +25°C ±3°C (see figure 4). No heat sink or forced air cooling directly on the device shall be permitted.
B4	2037	Test condition A.
B5 and B6	Not applicable.	

4.4.3 Group C inspection. Group C inspection shall be conducted in accordance with the conditions specified for subgroup testing in table VII of MIL-PRF-19500. Electrical measurements (end-points) and delta requirements shall be in accordance with table I, subgroup II herein.

Subgroup	Method	Condition
C2	1056	Thermal shock (temperature cycling): Test condition A.
C2	2036	Terminal strength, test condition E. Not applicable to surface mount devices.
C2	1071	Fine leak - condition G or H; gross leak - condition C.
C3	2016	Non-operating; 1,500 G, t = 0.5 ms, 5 blows in each orientation: X_1, Y_1, and Y_2.
C3	2056	50 G minimum. Non-operating.
C3	2006	Non-operating, 30,000 G, X_1, Y_1, and Y_2, orientations.
C6	1026	I_F = 20 mA dc, P_T = 275 ±25 mW at T_A = +25°C ±3°C, T = 1,000 hours (see figure 4). No heat sink or forced air cooling directly on the device shall be permitted.

4.4.4 Group E inspection. Group E inspection shall be conducted in accordance with MIL-PRF-19500 and table II herein.

4.5 Methods of inspection. Methods of inspection shall be as specified in the appropriate tables and as follows:

4.5.1 Pulse measurements. Conditions of pulse measurements shall be as specified in MIL-STD-750.

4.5.2 High temperature isolation voltage lot verification. This test shall be performed by shorting both the anode and cathode terminals of the LED (light emitting diode) and shorting together the collector, emitter, and base terminals of the transistor. The sample shall be split into two approximately equal groups and the specified isolation voltage (V_{ISO}) applied between the LED terminals (positive) and transistor terminals (negative) of one group. The specified isolation voltage shall be repeated with the LED terminals (negative) and the transistor terminal (positive) for the remaining group. All voltages shall be applied at the specified ambient temperature.

4.5.3 Input LED tests. These tests shall be performed with the output transistor terminals open.

4.5.4 Output transistor tests. These tests shall be performed with the input LED terminals open.

4.5.5 Isolation and coupling capacitance tests. These tests shall be performed between both input terminals 5 and 7 shorted together and the output terminals 1, 2, and 3 shorted together (see figure 1) or input terminals 1 and 6 shorted together and output terminals 3, 4, and 5 shorted together (see figure 2).

4.5.6 Monitored temperature cycling. One cycle of monitored temperature cycling shall be performed. All junctions shall be monitored for electrical continuity. Any discontinuity shall be cause for rejection of the device under test.

4.6 Internal visual inspection (JANTXV and JANS only). Internal visual inspection shall be performed in accordance with methods 2072 and 2073 of MIL-STD-750, and as specified herein. Method 2072 shall be used for inspecting transistor die and completed assembly. Method 2073 shall be used for inspecting light emitting diode.

* 4.6.1 Gallium arsenide or gallium aluminum arsenide light emitting diode die inspection. The die shall be inspected under 100X magnification.

* 4.6.2 Silicon phototransistor visual inspection. The die shall be inspected under 100X magnification.

* TABLE I. Group A inspection.

Inspection 1/	MIL-STD-750		Symbol	Limit		Unit
	Method	Conditions		Min	Max	
Subgroup 1						
Visual and mechanical inspection	2071					
Subgroup 2 2/						
LED characteristics:						
Reverse current leakage	4016	V_R = 2 V dc (see 4.5.3)	I_R		100	µA dc
Forward voltage	4011	I_F = 10 mA dc (see 4.5.3)	V_{F1}	0.8	1.5	V dc
Forward voltage	4011	I_F = 250 uA dc (see 4.5.3)	V_{F2}		1.2	Vdc
Transistor characteristics:						
Collector to emitter breakdown voltage	3011					
4N47, 4N47A, 4N47U 4N48, 4N48A, 4N48U 4N49, 4N49A, 4N49U		I_C = 1 mA dc, I_B = 0, I_F = 0 (see 4.5.4)	$V_{(BR)CEO}$	40		V dc
4N49BU				60		V dc
Collector to base breakdown voltage	3001					
4N47, 4N47A, 4N47U 4N48, 4N48A, 4N48U 4N49, 4N49A, 4N49U		I_C = 100 µA dc, I_F = 0, I_E = 0 (see 4.5.4)	$V_{(BR)CBO}$	45		V dc
4N49BU				60		V dc
Emitter to base breakdown voltage	3026	I_E = 100 µA dc, I_C = 0, I_F = 0 (see 4.5.4)	$V_{(BR)EBO}$	7		V dc
Off-state collector current phototransistor mode:	3041	V_{CE} = 20 V dc, I_B = 0, I_F = 0, condition D (see 4.5.4)	$I_{C(OFF)1}$		100	nA dc
DC current gain	3076	V_{CE} = 5 V; I_C = 10 mA dc, I_F = 0 (see 4.5.4)	h_{FE}	100		
Coupler characteristics:						
On-state collector current phototransistor mode:	3041	V_{CE} = 5 V dc, I_F = 1 mA dc	$I_{C(ON)1}$			
4N47, 4N47A, 4N47U 4N48, 4N48A, 4N48U 4N49, 4N49A, 4N49U, 4N49BU				0.5 1.0 2.0	 5.0 10.0	mA dc mA dc mA dc

See footnotes at end of table.

* TABLE I. Group A inspection - Continued.

Inspection 1/	MIL-STD-750		Symbol	Limit		Unit
	Method	Conditions		Min	Max	
Subgroup 2 - Continued 2/						
Collector to emitter saturation voltage			$V_{CE(SAT)}$			
4N47, 4N47A, 4N47U		I_C = 0.5 mA dc, I_F = 2 mA dc			0.3	V dc
4N48, 4N48A, 4N48U		I_C = 1 mA dc, I_F = 2 mA dc			0.3	V dc
4N49, 4N49A, 4N49U, 4N49BU		I_C = 2 mA dc, I_F = 2 mA dc			0.3	V dc
Subgroup 3 2/						
High temperature operation		T_A = +100°C				
Transistor characteristics:						
Off-state collector current phototransistor mode:	3041	V_{CE} = 20 V dc, I_F = 0, I_B = 0, condition D (see 4.5.4)	$I_{C(OFF)2}$		100	µAdc
Coupler characteristics:						
On-state collector current phototransistor mode:	3041	V_{CE} = 5 V dc, I_F = 2 mA dc	$I_{C(ON)2}$			
4N47, 4N47A, 4N47U				0.5		mA dc
4N48, 4N48A, 4N48U				1.0		mA dc
4N49, 4N49A, 4N49U, 4N49BU				2.0		mA dc
LED characteristics:						
Forward voltage	4011	I_F = 10 mA dc (see 4.5.3)	V_{F3}	0.7	1.3	V dc

See footnotes at end of table.

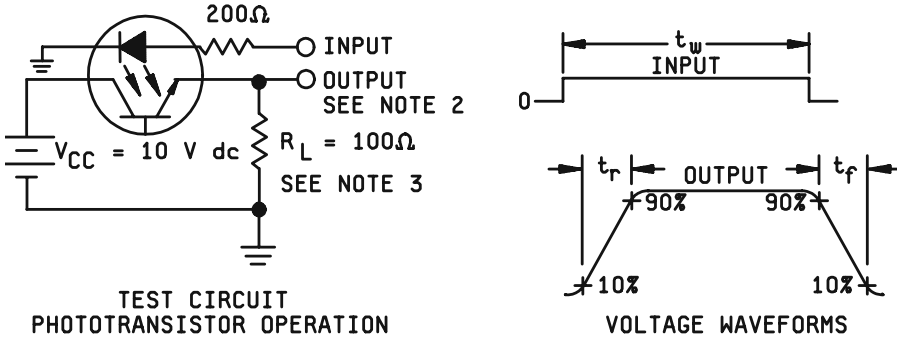
* TABLE I. Group A inspection - Continued.

Inspection 1/	MIL-STD-750		Symbol	Limit		Unit
	Method	Conditions		Min	Max	
Subgroup 3 - Continued 2/						
Low temperature operation		T_A = -55°C				
Coupler characteristics:						
On-state collector current phototransistor mode:	3041	V_{CE} = 5 V dc, I_F = 2 mA dc	$I_{C(ON)3}$			
4N47, 4N47A, 4N47U				0.7		mA dc
4N48, 4N48A, 4N48U				1.4		mA dc
4N49, 4N49A, 4N49U, 4N49BU				2.8		mA dc
LED characteristics:						
Forward voltage	4011	I_F = 10 mA dc (see 4.5.3)	V_{F4}	1.0	1.7	V dc
Subgroup 4 2/						
Input to output capacitance		f = 1 MHz, (see 4.5.5), $\|V_{IN-OUT}\|$ = 0	C_{IO}		5	PF
Input to output internal resistance	1016	$\|V_{IN-OUT}\|$ = 1 k V dc (see 4.5.5)	R_{IO}	10^{11}		Ω
Rise time (phototransistor mode)		V_{CC} = 10 V dc, I_F = 5 mA dc, R_L = 100 ohms (see figure 3)				
4N47, 4N47A, 4N47U			t_r		20	µs
4N48, 4N48A, 4N48U					20	µs
4N49, 4N49A, 4N49U, 4N49BU					20	µs
Fall time phototransistor mode:		V_{CC} = 10 V dc, I_F = 5 mA dc, R_L = 100 ohms (see figure 3)	t_f		20	µs
					20	µs
					20	µs
Rise time photodiode mode:		V_{CC} = 10 V dc, I_F = 5 mA dc, R_L = 100 ohms (see figure 3)	t_r		3	µs
Fall time photodiode mode:		V_{CC} = 10 V dc, I_F = 5 mA dc, R_L = 100 ohms (see figure 3)	t_f		3	µs
Subgroups 5, 6, and 7						
Not applicable						

1/ For sampling plan, see MIL-PRF-19500.
2/ All devices required by the specified sampling plan are subjected to subgroups 2, 3, and 4 combined (JANS only).

TABLE II. Group E inspections (all quality levels) for qualification only.

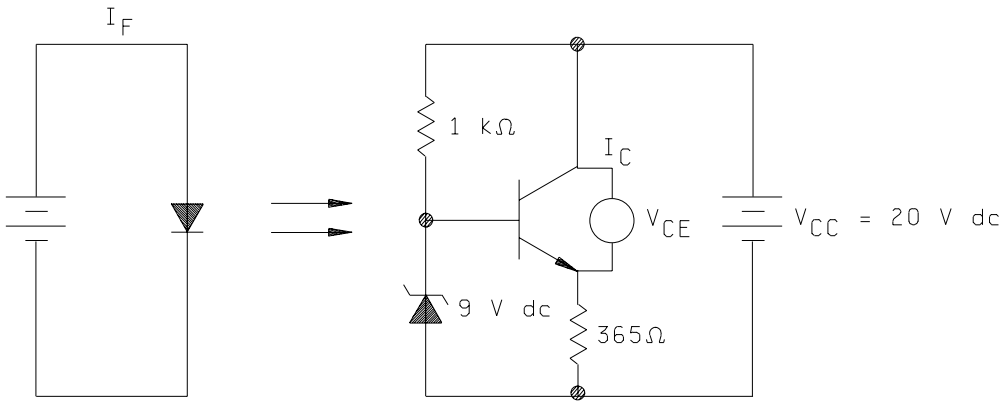
Inspections	MIL-STD-750		Quality conformance inspection sample size.
	Method	Conditions	
Subgroup 1			45 devices, c = 0
Thermal shock (temperature cycle)	1051	Test condition B, 500 cycles	
Hermetic seal	1071		
a. Fine leak b. Gross leak		Condition G or H for fine leak Condition C for gross leak	
Electrical measurements		See screen 13 of 4.3	
Subgroup 2			45 devices, c = 0
High temperature reverse bias	1039	For all devices with organic material.	
Electrical measurements		See screen 13 of 4.3	



NOTES:

1. The input waveform is supplied by a generator with the following characteristics: Z_{OUT} = 50 Ω, $t_r \leq 15$ ns, duty cycle = 1 percent; t_w = 100 µs.
2. The output waveform is monitored on an oscilloscope with the following characteristics: $t_r \leq 12$ ns, R_{in} = 1 MΩ, C_{in} = 20 pF.
3. Adjust amplitude of input for: I_F = 10 mA dc.

FIGURE 3. Switching times.



NOTES:
1. I_F = 20 mA dc for operation life tests.
2. I_F = 40 mA dc for burn-in of TX, TXV, and S.

* FIGURE 4. Operation life test burn-in circuit.

5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When actual packaging of materiel is to be performed by DoD personnel, these personnel need to contact the responsible packaging activity to ascertain requisite packaging requirements. Packaging requirements are maintained by the Inventory Control Points' packaging activity within the Military Department or Defense Agency, or within the Military Departments' System Command. Packaging data retrieval is available from the managing Military Departments' or Defense Agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

6. NOTES

(This section contains information of a general or explanatory nature that may be helpful, but is not mandatory.)

6.1 Notes. The notes specified in MIL-PRF-19500 are applicable to this specification.

6.2 Acquisition requirements. Acquisition documents must specify the following:

a. Title, number, and date of this specification.

b. Issue of DODISS to be cited in the solicitation and, if required, the specified issue of individual documents referenced (see 2.2.1).

c. Lead finish (see 3.4.1 and 3.4.2).

d. Type designation and product assurance level.

e. Packaging requirements (see 5.1).

6.3 Qualification. With respect to products requiring qualification, awards will be made only for products which are, at the time of award of contract, qualified for inclusion in Qualified Manufacturer's List QML-19500 whether or not such products have actually been so listed by that date. The attention of the contractors is called to these requirements, and manufacturers are urged to arrange to have the products that they propose to offer to the Federal Government tested for qualification in order that they may be eligible to be awarded contracts or orders for the products covered by this specification. Information pertaining to qualification of products may be obtained from Defense Supply Center Columbus, ATTN: DSCC-VQE, P.O. Box 3990, Columbus, OH 43216-5000.

6.4 Changes from previous issue. The margins of this specification are marked with asterisks to indicate where changes from the previous issue were made. This was done as a convenience only and the Government assumes no liability whatsoever for any inaccuracies in these notations. Bidders and contractors are cautioned to evaluate the requirements of this document based on the entire content irrespective of the marginal notations and relationship to the last previous issue.

Custodians:
Army - CR
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Air Force - 11
NASA - NA
DLA - CC

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(Project 5980-0031)

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I RECOMMEND A CHANGE:	1. DOCUMENT NUMBER MIL-PRF-19500/548E	2. DOCUMENT DATE 3 September 2003

3. **DOCUMENT TITLE** COUPLER, OPTO ELECTRONIC, SEMICONDUCTOR DEVICE, SOLID STATE, TYPES 4N47, 4N47A, 4N48, 4N48A, 4N49, 4N49A, 4N47U, 4N48U, 4N49U, AND 4N49BU, JAN, JANTX, JANTXV, AND JANS

4. NATURE OF CHANGE (Identify paragraph number and include proposed rewrite, if possible. Attach extra sheets as needed.)

5. REASON FOR RECOMMENDATION

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8. PREPARING ACTIVITY

a. Point of Contact Alan Barone	b. TELEPHONE Commercial 614-692-0510	DSN 850-0510	FAX 614-692-6939	EMAIL alan.barone@dla.mil
c. ADDRESS Defense Supply Center Columbus ATTN: DSCC-VAC P.O. Box 3990 Columbus, OH 43216-5000	IF YOU DO NOT RECEIVE A REPLY WITHIN 45 DAYS, CONTACT: Defense Standardization Program Office (DLSC-LM) 8725 John J. Kingman, Suite 2533 Fort Belvoir, VA 22060-6221 Telephone (703) 767-6888 DSN 427-6888			